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ABSTRACT

Researchers conducted the first cost-benefit analysis of a federally-financed, comprehensive early childhood program involving the Title I Chicago Child-Parent Centers, which are located in public schools and provide educational and family support services to low-income children ages 3-9 years. Data came from a cohort of children born in 1980 who participate in the Chicago Longitudinal Study. Findings indicated that the measured and projected economic benefits of preschool participation, school-age participation, and extended program participation exceeded costs. The preschool program provided a return to society of $7.14 per dollar invested by increasing economic well-being and tax revenues and reducing public expenditures for remedial education, criminal justice treatment, and crime victims. The extended intervention program (4 to 6 years of participation) provided a return to society of $6.11 per dollar invested, while the school-age program yielded a return of $1.66 per dollar invested. Economic benefits to the general public, exclusive of individual earnings, also exceeded costs for all levels of program participation. Findings demonstrate the cost-effectiveness of public early childhood programs. Breakdown of Benefits and Costs for Estimating Economic Returns of the Chicago Child-Parent Centers is appended. (Contains 51 references, 11 figures, and 7 tables.) (SM)

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Age 21 Cost-Benefit Analysis of the Title I Chicago Child-Parent Centers

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Abstract

We conducted the first cost-benefit analysis of a federally financed, comprehensive early childhood program. The Title I Chicago Child-Parent Centers are located in public schools and provide educational and family support services to low-income children from ages 3 to 9. Using data from a cohort of children born in 1980 who participate in the Chicago Longitudinal Study, findings indicated that the measured and projected economic benefits of preschool participation, school-age participation, and extended program participation exceeded costs. The preschool program provided a return to society of $7.14 per dollar invested by increasing economic well-being and tax revenues, and by reducing public expenditures for remedial education, criminal justice treatment, and crime victims. The extended intervention program (4 to 6 years of participation) provided a return to society of $6.11 per dollar invested while the school-age program yielded a return of $1.66 per dollar invested. Economic benefits to the general public, exclusive of individual earnings, also exceeded costs for all three levels of program participation. Findings demonstrate the cost-effectiveness of public early childhood programs.

Age 21 Cost-Benefit Analysis of the Title I Chicago Child-Parent Centers

Research over four decades indicates that early childhood interventions have beneficial effects on children's health and well-being. Participation in a variety of interventions of good quality is associated with improved health status, cognitive skills, achievement motivation, and school readiness in the short term as well as school achievement, educational attainment, and reductions in remedial services and criminal behavior in the longer term.[1-8] Because they can improve children's educational and socioeconomic prospects, early childhood programs are believed to be cost effective. Relatively little evidence exists, however, that these preventive interventions provide long-term benefits that substantially exceed costs. Given that the annual cost to the nation of school dropout and crime in the United States is estimated to be $350 billion,[9,10] the identification of cost-effective prevention programs can reduce public expenditures devoted to later treatment and remedial services. The cost-effectiveness of large-scale early childhood interventions is unknown. At a time when annual state and federal expenditures for early care and education exceed $15 billion, better understanding is needed of the long-term benefits of these investments to society at large.[11]

Cost-benefit analyses show promising evidence that three early childhood interventions can be an efficient use of public resources. A meta-analysis of studies of the federally funded Special Supplemental Food Program for Women, Infants, and Children (WIC) found that reductions in rates of low and very low birth weight led to substantial savings in hospitalization costs for infants in the first year of life.[12] Each dollar spent on WIC was found to return $3.07 in medical savings to Medicaid and private payers. Two model programs that provide a broader array of child and family services also show cost-effectiveness. Participation in the Prenatal/Early Infancy Project, a nurse home-visitation program for young mothers having their first child, was associated with improved maternal and child outcomes into adulthood that totaled about $30,000 per participant (a return of $5 per dollar invested) in government savings on welfare spending, criminal justice system, and tangible crime-victim costs.[4,13] The

High/Scope Perry Preschool Program also showed substantial cost-effectiveness. Participation in this center-based program beginning at age 3 was associated with public benefits totaling about $45,000 per child (a return of $4 per dollar invested) at age 27 in increased tax revenues associated with higher measured and projected earnings, reduced expenditures to the criminal justice system, reduced tangible losses to crime victims, and reduced expenditures for remedial education.[14] With participants' increased earning capacity and averted intangible costs to crime victims added, the total societal benefit was about $9 per dollar invested. Both interventions resulted in savings to the government of about $25,000 per participant.[4] Although these studies show substantial reductions in expenditures on remedial education, criminal justice, and social services, corresponding evidence is needed from contemporary early childhood programs administered through established educational and social institutions.

Research in the Chicago Child-Parent Center (CPC) Program, a multisite, federally funded intervention operating in the Chicago public schools, has indicated that participation beginning in preschool is associated with several behavioral outcomes that predict later economic and social well-being—including higher cognitive skills, greater school achievement, and improved consumer skills—and with lower incidence of school remedial services in early adolescence.[15–18] In the most recent study in May 2001,[19] relative to participation in an alternative program, CPC preschool participation at ages 3 or 4 was associated with significantly higher rates of school completion by age 20, with lower rates of official juvenile arrests, violent arrests, and multiple arrests by age 18, and with lower rates of special education services and grade retention. Males experienced greater benefits than their female counterparts in educational attainment. School-age participation and extended program participation for 4 to 6 years were associated with lower rates of special education services and grade retention. These outcomes are suggestive of sizable economic benefits to participants and society.

In this study, we conduct the first cost-benefit analysis of an established, large-scale early childhood intervention for preschool children and their families. Funded by Title I of the Elementary and

Secondary Education Act of 1965, CPC is, after Head Start, the nation's oldest federally funded preschool program. It shares with Head Start a focus on comprehensive services. Opened in 1967, the program provides services from ages 3 to 9 in 24 sites in high-poverty neighborhoods. Using data from the ongoing Chicago Longitudinal Study, we investigate the benefits of preschool participation, school-age participation, and extended program participation in (1) reducing expenditures for school remedial services through the end of high school, including special education and grade retention, (2) reducing criminal justice system expenditures associated with arrest, adjudication, and treatment for both juvenile and adult crime, (3) reducing child welfare system expenditures associated with child maltreatment, (4) averting tangible costs to victims of crime and child maltreatment, and (5) increasing earnings capacity and tax revenues as a consequence of higher rates of high school completion. Given our earlier findings, we hypothesized that the overall benefits of program participation to the general public and society at large would exceed costs and that the benefits of preschool participation relative to costs would exceed those for school-age intervention and extended intervention. We also expected that the monetary benefits of participation for males would exceed those for females.

METHODS

Sample and Design

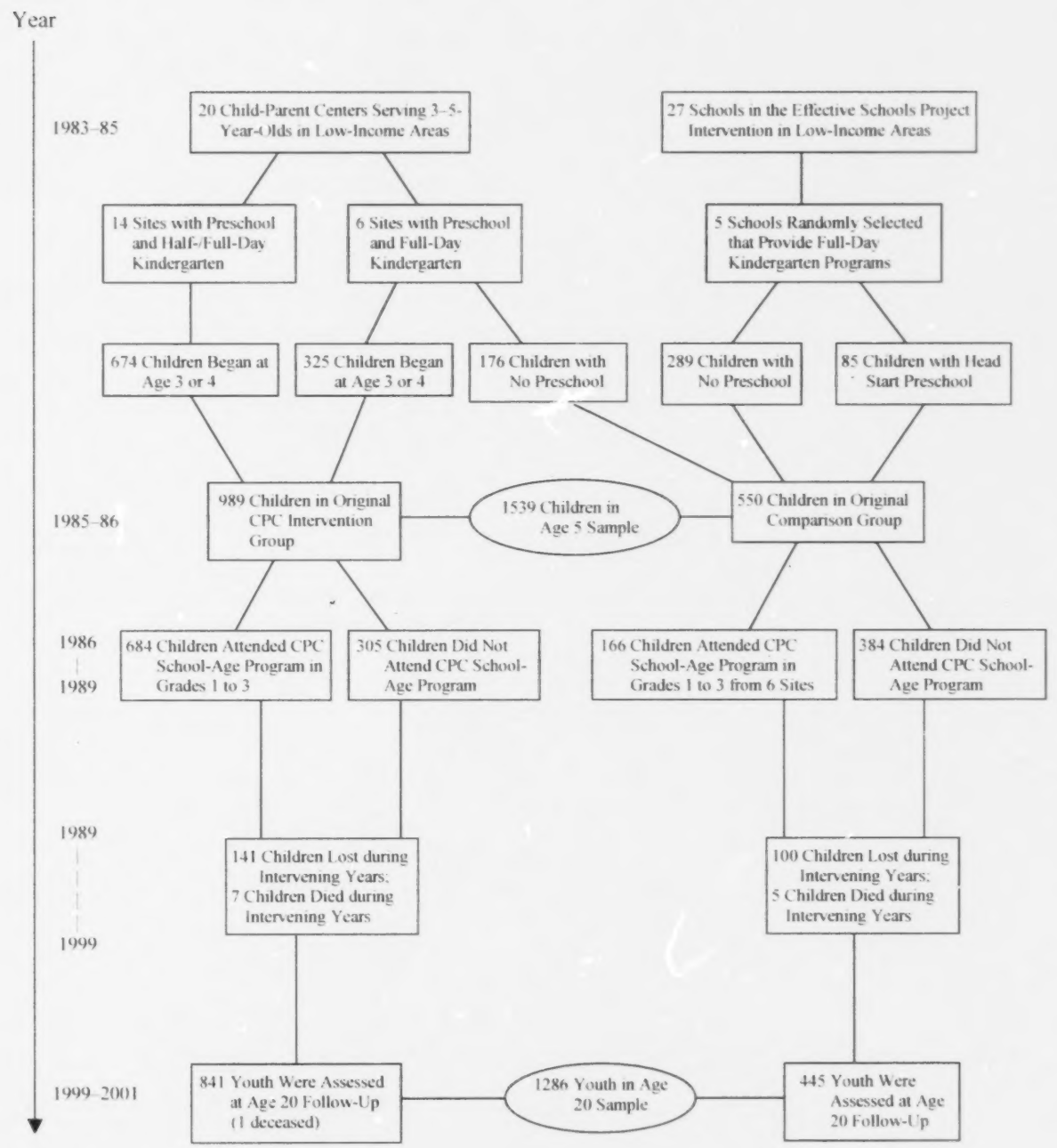
The Chicago Longitudinal Study investigates the life-course development of 1,539 children from low-income families; 93 percent are black and 7 percent are Hispanic. Born in 1980, children and families in this ongoing study attended kindergarten programs in 25 sites in 1985–86.[15, 20] The original sample included the entire cohort of 989 children who completed preschool and kindergarten in all 20 Child-Parent Centers with combined programs and 550 low-income children who did not attend the program in preschool but did participate in a full-day kindergarten program in five randomly selected schools and in several schools affiliated with the Child-Parent Centers. Twenty-three percent of the

comparison group attended Head Start preschool; the remaining children were in home care. In this quasi-experimental design, the comparison group matched the program group on age, eligibility for intervention, and family socioeconomic status. The eligibility criteria for the program are (1) residence in a Title I school attendance area (i.e., serves high proportions of low-income families), (2) demonstration of substantial educational need due to poverty and associated factors, and (3) parents agree to participate. Since 1985, data have been collected yearly on a wide variety of educational, social, and family experiences from school records, teachers, parents, and children.

As reported previously,[19] we assessed the impact of CPC program participation beginning at age 3 on later well-being above and beyond participation in the "treatment as usual" for low-income children in Chicago in the mid-1980s. The usual services included an enriched all-day kindergarten and, for the most part, no center-based preschool. The effect of the preschool program was estimated by comparing the performance of the preschool group against the comparison group. The effect of the school-age program was assessed by comparing children participating in the school-age program with those not participating in the school-age program regardless of their preschool participation. The effect of the extended intervention was assessed by comparing children with 4 to 6 years of participation beginning in preschool and children with 1 to 3 years of participation at any time.

The patterns of participation and postprogram data collection are shown in **Figure 1**. In September 2000 (mean age of 20.3 years), 1,286 children (83.6 percent of the original sample) had data for at least one of several study outcomes. The educational attainment status was known for 85.0 percent and 80.9 percent of the original preschool and comparison groups, respectively, with no evidence of selective attrition.[15, 21] Sample recovery was higher for records of juvenile arrest (N = 1,404). Program outcomes were measured from school records, family and youth surveys, and court records.

Figure 1
Flowchart of Study Sites and Participants in the Chicago Longitudinal Study, Preschool to Age 20


Year
1983–85
20 Child-Parent Centers Serving 3–5-Year-Olds in Low-Income Areas
27 Schools in the Effective Schools Project Intervention in Low-Income Areas
14 Sites with Preschool and Half-/Full-Day Kindergarten
6 Sites with Preschool and Full-Day Kindergarten
5 Schools Randomly Selected that Provide Full-Day Kindergarten Programs
674 Children Began at Age 3 or 4
325 Children Began at Age 3 or 4
176 Children with No Preschool
289 Children with No Preschool
85 Children with Head Start Preschool
1985–86
989 Children in Original CPC Intervention Group
1539 Children in Age 5 Sample
550 Children in Original Comparison Group
1986
1989
684 Children Attended CPC School-Age Program in Grades 1 to 3
305 Children Did Not Attend CPC School-Age Program
166 Children Attended CPC School-Age Program in Grades 1 to 3 from 6 Sites
384 Children Did Not Attend CPC School-Age Program
1989
1999
141 Children Lost during Intervening Years; 7 Children Died during Intervening Years
100 Children Lost during Intervening Years; 5 Children Died during Intervening Years
1999–2001
841 Youth Were Assessed at Age 20 Follow-Up (1 deceased)
1286 Youth in Age 20 Sample
445 Youth Were Assessed at Age 20 Follow-Up

Group Comparability

As shown in **Table 1**, the original intervention and comparison groups at the beginning of the study and at the age 21 follow-up were similar on many characteristics. These characteristics were measured from school records and family surveys from the preschool years to children's age 12. The family risk index, a sum of six dichotomous factors associated with lower levels of adjustment (e.g., low parental education, family poverty), provides an overall summary of these characteristics. The mean of the risk index was equivalent between groups. Preprogram rates of reported child abuse and neglect and of teenage parenthood also were similar between groups. Extended and school-age intervention groups showed similar patterns. Among the follow-up sample, the intervention group had a higher proportion of girls, a higher proportion of parents who had completed high school, and fewer siblings. Alternatively, the intervention group was more likely than comparison group to reside in neighborhoods with higher poverty and higher unemployment. The latter differences are the result of the centers being located in the most disadvantaged neighborhoods. Because of these higher levels of neighborhood disadvantage and because the comparison group participated in alternative interventions, findings are likely to lead to conservative estimates of program effects.

Chicago Child-Parent Center Program

Since the CPC program is described fully in previous reports,[15, 19] we provide a summary of the main features in this section. Located in or close to public elementary schools, the CPC program provides educational and family-support services to children between the ages of 3 and 9 (preschool to second or third grade; see **Figure 2**). Within a structure of comprehensive services similar to Head Start, the intervention emphasizes the acquisition of basic skills in language arts and math through relatively structured but diverse learning experiences that include teacher-directed, whole-class instruction, small-group activities, frequent field trips, and play. Literacy experiences involving word analysis, oral

TABLE 1
Equivalence of Program and Comparison Groups on Background Attributes for Age 20 Follow-up Sample and Original Sample at Beginning of Study

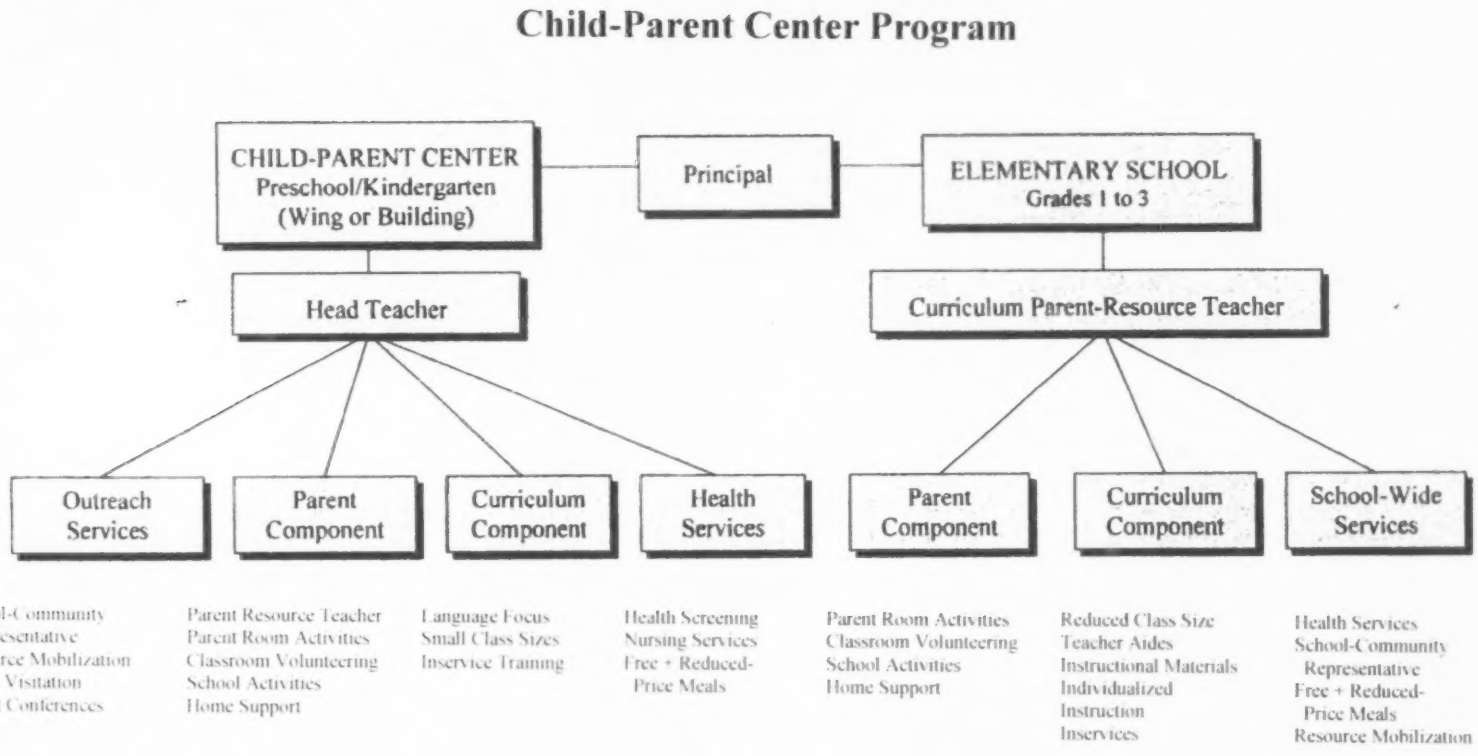
Child/Family Attribute	Preschool Group (n = 841)	Comparison Group (n = 445)	p-value	Original Sample p-value
Female child, %	52.3	46.3	.017	.117
African American, %	94.0	92.6	.315	.945
Risk index (0–6), mean (SD)	3.56 (1.3)	3.62 (1.4)	.406	.095
High school-poverty (>60%)*, %[a]	77.1	71.9	.027	.038
Child eligible for subsidized meals (<130% of family poverty)*, %	92.3	92.8	.772	.787
Parent completed high school*, %	66.1	59.3	.033	.017
Single-parent status*, %	69.6	65.7	.223	.269
Parent not employed full time by child's age 12*, %	64.9	60.8	.204	.606
Missing parent education or meals, %	7.0	8.5	.329	.044
Mean number of siblings*	2.6	2.8	.007	.043
Parent was under age 20 at child's birth, %	23.2	19.2	.154	.250
Child abuse or neglect by age 4, (indicated report, %)	1.1	1.3	.662	.951
Census-tract poverty, age 4, mean (SD), %	46.0 (13.5)	39.9 (11.9)	<.001	<.001
Census-tract unemployment, age 4, mean (SD), %	24.3 (6.0)	22.8 (5.0)	<.001	<.001

* Variable included in risk index.

[a]The 60% figure is the percentage of children in the school attendance areas who are from low-income families.

Notes. N = 1,286. Sample sizes vary by factor. Data collected from preschool to age 12. p-values show the significance of mean (or percentage) group differences for the age 20 and original samples, respectively. Census information is the average of 1980 and 1990 data.

Figure 2
CPC Program Model



communication, and listening skills are highlighted as described in the instructional activity guide.[22] **Table 2** shows the intervention experiences of the program and comparison groups.

At the time of the study sample's participation, each of the 24 centers served approximately 100 to 150 children aged 3 to 5 years (one center closed in 1987). The centers are located in the poorest neighborhoods in Chicago. The mean rate of family poverty in 1989 for the community areas serving the CPCs was 41 percent versus 17 percent for other areas of the city. Each center is directed by a head teacher and two coordinators. The parent-resource teacher coordinates the family-support component. The school-community representative provides outreach to families. The program was located in areas not being served by other preschool programs, and rates of participation exceed 80 percent in the neighborhoods of the CPCs. The low-income status of the families precluded enrollment in nonpublic care or education programs.

The preschool program runs 2.5 hours per day, 5 days per week during the 9-month school year, and usually includes a 6-week summer program. After full-day or part-day kindergarten, continuing services are provided in the affiliated schools under the direction of the curriculum parent-resource teacher. Participation in the school-age intervention is open to any child in the school, either in first and second grade in 14 sites or first through third grade in six sites.

Major elements of the program include:

- a structured set of educational activities emphasizing reading and math skills, and complemented with other instructional materials such as Language Lotto, Alpha Time, and Peabody Language Development Kits;
- low child-to-staff ratios in preschool (17:2) and kindergarten (25:2);
- an intensive parent program that includes participating in parent room activities volunteering in the classroom, attending school events and field trips, and completing high school;
- outreach activities including resource mobilization, home visitation, and enrollment of children;

TABLE 2
Levels of Program Participation for Child-Parent Center and Comparison Groups in the Chicago Longitudinal Study

Sample Characteristic	CPC Intervention Group	Comparison Group
Original sample size	989	550
Preschool participation, %	100	23 (Head Start)
No. of cases, 1 year	455	38
No. of cases, 2 years	534	47
Mean no. of years	1.55	0.15
Kindergarten participation, %	100	100
Full-day program, %	59.9	100
School-age participation, %	69.2	30.2
No. of cases, 1 year	129	38
No. of cases, 2 or 3 years	555	128
Extended participation, %	55.9	0.0
No. of cases, 4 years	156	0
No. of cases, 5 years	313	0
No. of cases, 6 years	84	0
Total no. of years of CPC program participation	3.95	0.68
No. of cases at age 20 follow-up with at least one outcome	841	445

- regular staff development activities for teachers, all of whom have bachelor's degrees, are certified in early childhood education, and, as public-school employees, are relatively well-paid;
- health and nutrition services, including health screening, speech therapy, and nursing and meal services; and
- comprehensive school-age services including reduced class sizes (25 rather than 35+ children), teachers' aides for each class, parent program activities, extra instructional materials, and activities to enrich reading and math skills.

Economic Methods

As a public investment in the lives of children and families, the Chicago Child-Parent Center Program is expected to provide benefits to participants that would be manifested many years later in school achievement, utilization of remedial and treatment services, educational attainment, and social functioning. A cost-benefit analysis is warranted because these short- and long-term outcomes of the program have measurable economic benefits. Moreover, the length, intensity, and breadth of services provided in this preventive intervention are substantially greater than in most other intervention programs.[15] Previous reports from this study have demonstrated with a high level of confidence that program participation is independently linked to better child and youth outcomes.[15-19] Following standard economic procedures,[23,24] we estimated the present value of program benefits in 1998 dollars for five main categories: (1) reductions in expenditures for school remedial services, including special education and additional schooling required for retained students, (2) reductions in criminal justice system expenditures for both juvenile and adult arrest and treatment, (3) reductions in child welfare system expenditures, (4) averted tangible expenditures to crime victims as a result of lower rates of arrest and to victims of child maltreatment, and (5) increases in projected earnings of program participants and tax revenues as a result of higher rates of high school completion. We did not estimate the benefits of the program on welfare participation. The parents of program and comparison-group participants had

comparable rates of welfare participation. Complete public aid data for participating youth are not yet available.

We distinguish three types of benefits in our analysis. Benefits to participants are returned to the child and parent attending the program but do not directly benefit others in society. These benefits include increased earnings capacity in adulthood projected from educational attainment as well as the benefit to parents from the provision of part-day care for children. Benefits to the general public include averted expenditures of remedial education and social welfare spending by governments, reduced tangible expenditures to crime victims as a result of lower rates of crime, and increased tax revenues to state and federal governments as a result of higher earnings capacity. Benefits to society at large include the sum of benefits to program participants and to the general public. We emphasize benefits to the general public in this report although estimates to all three groups are presented, plus savings to governments.

Based on the above framework and given our estimates of program impact, we used the following procedure to calculate benefits and costs of CPC participation: (a) program costs and benefits are calculated in dollar terms, (b) the dollar values are converted to 1998 dollars to adjust for inflation, (c) the present values of future costs and benefits are computed in 1998 dollars and evaluated at a baseline age of 3 using an annual discount rate of 3 percent, and (d) the present value of program costs is subtracted from the present value of program benefits to obtain the net present value of the intervention. Because it is common to estimate the lifetime earnings benefits from high school completion and adult crime from juvenile crime, future benefits in these domains were projected throughout adulthood.[4, 14] The present value of benefits is estimated at the beginning of the program at age 3 for all levels of program participation. Our choice of discount rate was recommended by the U. S. Public Health Service and the U. S. General Accounting Office.[24, 25] Alternative rates were tested as part of sensitivity analysis.

Program Costs

The costs of the CPC program per participant were estimated for the preschool and school-age components of the program and for extended program participation (4 or more years of participation beginning in preschool). As shown in **Table 3**, these taxpayer costs include all outlays for staff, family and community support, administration, operations and maintenance, instructional materials, transportation and community services, school-wide services, school district support, and capital depreciation and interest. Costs of the preschool program were based on the operational budget of the program for the 1985–86 year.[26] The largest cost categories for the preschool program were instructional staff, administration, operations and maintenance, family and community staff, and imputed capital depreciation and interest. The latter are based on replacement costs of the preschool centers and forgone interest estimated over 50 years.[27] These costs were supplemented with others including opportunity costs for parent participation. Costs for the school-age program are based on expenditures for the 1986–87 year.[26, 28] The largest category for the school-age program was instructional staff: teachers and teachers' aides for the reduction of class sizes and child-to-staff ratios in each class. The present value of the average cost of the preschool program was $6,692 per participant. This cost is based on an average length of participation of 1.5 years. The average cost per child of 1 year of preschool was $4,400.

The present value of the average cost of the school-age program, above and beyond regular instruction, was $2,981 per participant. The cost of 1 year of school-age participation was $1,580 per child. The present value of the average cost of the extended program (4 to 6 years of participation) was $10,000 per child. The net cost of the extended program, above and beyond less extensive participation (1 to 4 years), was $4,057 per child ($10,000 minus $5,943). The present value of the average cost of the total program (preschool + school-age) was $9,673 per child. Adjustments for inflation using the GDP implicit price deflator for state and local government services instead of the Consumer Price Index resulted in slightly lower estimates of average costs per participant. We did not include the costs for the

TABLE 3
Itemized Costs in 1998 Dollars of the Chicago Child-Parent Center Program: Preschool and School-Age Components

Budget Category	Preschool Program	School-Age Program
Instructional staff	$7,864,225	$7,849,856
Family and school-community staff/parent program	1,744,945	25,634
Administration	2,288,153	1,481,416
Operations and maintenance	1,905,311	
Instructional materials	140,772	117,621
Capital outlays and equipment	76,075	118,864
Transportation, food, and community services	85,364	42,796
School-wide services	779,901	
School district support	141,632	140,744
Parent program participation	1,421,695	897,300
Capital depreciation and interest	1,652,121	
Total cost in 1998 dollars	18,100,194	10,674,231
Number of children in 25 centers/schools	4,114	6,757
Average cost per child for 1 year	4,400	1,580
Present value of weighted average cost per child	6,692	2,981
Present value of the weighted average cost per child for 4 to 6 years of CPC participation	10,000	
Amount above and beyond participation for 1 to 4 years of intervention	4,057	

Note. Original program costs (nominal dollars) for the preschool program were from 1985–86 and for the school-age program from 1986–87. They were converted to 1998 dollars using the Consumer Price Index (CPI-U). The 1986, 1987, and 1998 CPI-U values were, respectively, 109.6, 113.6, and 168.0. The present value was evaluated at age 3 using a discount rate of 3%. The present value of the weighted average cost of 1 to 4 years of intervention (less-extensive participation) was $5,943.

half-day or full-day CPC kindergarten program. This is because the comparison group participated in an all-day kindergarten program that approximated or exceeded the expenditures for CPC kindergarten.[29] Unlike the CPC program, the kindergarten programs attended by the comparison group were all-day programs; 23 percent of the comparison group participated in Head Start preschool for 1 or 2 years.

Program Benefits

Reductions in Expenditures for School Remedial Services. Savings on school remedial services are estimated for grade retention and special education placement from kindergarten to grade 12. The consequence of grade retention is that a student will be expected to enroll in school for an additional year. We used the average per pupil annual expenditure in Chicago for general education as the estimate for an additional year of school.[30] The present value of an additional year of school at age 19 is $4,494 per child. Expenditures for special education are the weighted average annual cost per pupil reported by the Chicago Public Schools for four categories: specific learning disability, emotional or behavioral disturbance, speech and language impairment, and mental retardation.[31] These expenditures are above and beyond regular instruction. The outcome measure is the average number of years receiving special education services, with an annual present value of $5,971 per child.

Increases in Lifetime Earnings, Compensation, and Government Tax Revenues. Increases in lifetime earnings and compensation for ages 18 to 65 are projected from differences in high school completion between program and comparison groups. Obtained from school records and youth surveys, high school completion was defined as graduating from a regular high school or earning an equivalent diploma (e.g., GED) by age 20. We used U. S. Census and Labor Department data from 1999 for black full-time workers aged 25–29 to project lifetime earnings stratified by sex and four categories of educational attainment (less than high school, high school completion, some college, and 4 years of college or more).[32] Consistent with other lifetime earning projections,[14] our estimates assume a modest 3 percent discount rate, 2 percent real income growth rate, and a 20 percent fringe benefit rate. The present

value of after-tax lifetime earnings and compensation of blacks who complete high school or continue on to college would be expected to exceed the earnings of blacks who do not complete high school by $183,183. Because higher levels of educational attainment increase expenditures for attending college, our analysis also accounted for the cost of college tuition for individuals and the public.

Greater projected lifetime earnings of program participants would lead to a proportional increase in tax revenues to state and federal governments. We applied a 33.3 percent tax rate to the lifetime earnings estimates noted above. This includes a modest 15 percent federal tax, 3 percent state income tax, and 15.3 percent FICA tax. The estimated present value of increased tax revenues was projected to be $64,673.

Reductions in Expenditures in the Criminal Justice System for Youth and Adult Crime. Savings in the criminal justice system were determined based on the effect of the CPC program on juvenile arrests. Juvenile court records were obtained for each study participant through manual and computer searches of court records in Chicago and two other cities. Our measure of crime was petitions to the juvenile court. Estimated criminal justice system expenditures included the administrative expenditures associated with arrest and the weighted national average of the proportion of cases that led to residential treatment, community treatment, and release or probation.[33, 34] The highest cost is for residential treatment, with an annual expenditure per person of $32,237 in 1998 dollars in the county of residence of study participants.[35] The annual expenditure for probation services is $7,017 per person. Based on the mean age of arrest of 14, the present value of expenditures to the criminal justice system for juveniles with court petitions is $13,690 per participant.

Because the strongest predictor of adult crime is juvenile crime, our estimates for decreases in adult criminal justice system expenditures are projected from juvenile arrests. Following the procedures of previous studies,[4, 36] the effect of program participation on the arrest rate at the beginning of adulthood was estimated to be 80 percent of the effect observed for juvenile arrest, with a 10 percent rate of

desistance per year through age 44. The present value of the average cost of an adult criminal career evaluated at age 3 was estimated to be $32,973, and includes the costs of arrest, judicial processing, and treatment.

Reductions in Tangible Expenditures to Crime Victims: Youth and Adults. Crime-victim savings are direct expenditures incurred as a result delinquent or criminal behavior exclusive of pain and suffering. To estimate the value of these averted expenditures, we used national estimates of the amount and proportion of tangible losses to crime victims for violent and property offenses.[4, 14, 37] The present values of tangible expenditures per person to victims of juvenile and adult crimes were, respectively, $14,354 and $34,572. To determine the amount of savings to victims of juvenile crime, we multiplied the tangible expenditures per person by the mean number of juvenile arrests for violent and property charges. Projected savings to victims of adult crime were estimated from the present-value cost of an adult criminal career ($32,973 over ages 19–44),[36] based on a target population crime rate of 30 percent and an incidence of arrest that is 80 percent of juvenile arrest.

Reductions in Expenditures for the Child Welfare System and Victimization from Child Abuse and Neglect. Our measure of child maltreatment was referrals to the juvenile court by the Department of Child and Family Services between the ages of 4 and 17. These petitions were substantiated reports of child abuse and neglect. One-third of all reports of maltreatment to child welfare agencies are substantiated.[38] About 70 percent of substantiated cases receive in-home services, while the remaining cases are placed in foster care.[39] Court referrals are typically the most serious cases of maltreatment in which immediate out-of-home placement may be needed. We estimated that the weighted average expenditure per child for child welfare services for a substantiated report of child abuse and neglect is $9,492[39, 40] (1998 dollars). After adding administrative costs of $1,466 per child for judicial processing associated with petitions and assuming the referral occurs at an average age of 10, the present value of the average costs is $8,910 per child.

Victim costs were the tangible losses associated with child abuse as estimated by the National Institute of Justice.[37] They included medical care, mental health care, police/fire services, and lost productivity of victims and their families such as forgone wages, missed school days, and certain legal expenses. The present value of the average costs for child abuse victimization is $5,623 per child.

Statistical Analysis

Following previous reports,[18, 19] we used probit, linear, and negative binomial regression analysis to estimate program effects for the cost-benefit analysis. Coefficients were transformed to marginal effects in LIMDEP.[41] The amount of benefit was the adjusted difference in the average outcome between program and comparison groups multiplied by the monetary estimate of the outcome. The effects of preschool and school-age participation were estimated jointly. These dichotomous measures were entered simultaneously, with sex of child, race/ethnicity, family risk, and program sites as covariates. Extended program participation was compared to less extensive program participation rather than no participation. Kindergarten achievement test scores were entered as an additional covariate in estimating the effect of extended intervention. Effect sizes were robust across a range of model specifications and for different comparison groups, and were unaffected by attrition.

RESULTS

Program Effects from Kindergarten to Early Adulthood

Table 4 summarizes group differences for each level of program participation in the CPC for school achievement, family support, school remedial services, child maltreatment, juvenile crime, and educational attainment. The values are adjusted means or proportions controlling for sex of child, race/ethnicity, family risk index, and program sites. Of the family outcomes investigated, parent involvement in children's school has shown the most consistent effects. **Figure 3** displays the

TABLE 4
Domains of Effects for Three Measures of Participation in the Child-Parent Center Program

Domain and Measure	N	Preschool Group	Comparison Group	Diff.	p-value	School-Age Group	Comparison Group	Diff.	p-value
School Achievement									
Age 5 ITBS cognitive development	1102	49.6	43.3	6.3	<.001	—	—		
Age 6 ITBS word analysis	1531	66.0	59.8	6.2	<.001	—	—		
Age 9 ITBS reading achievement	1285	98.2	93.5	4.7	<.001	98.4	93.4	5.0	<.001
Age 14 ITBS reading achievement	1158	147.1	141.6	5.5	<.01	145.0	143.4	1.6	<.10
Age 14/15 consumer skills, % passing	1158	62.5	52.3	10.2	<.01	61.0	53.8	7.2	<.05
Family Support for Education									
No. of positive ratings (0–5) of parent involvement in school by parents/teachers, ages 8–12	1164	1.8	1.6	0.2	.019	1.8	1.6	0.2	.009
School Remedial Services									
Grade retention by age 15, %	1281	23.0	38.4	-15.4	<.001	23.8	34.3	-10.5	.001
Special education by age 18, %	1281	14.4	24.6	-10.2	<.001	15.4	21.3	-5.9	.02
No. of years of special education from ages 6 to 18	1281	0.73	1.43	-0.70	.06	0.76	1.24	-0.48	.08
Child Maltreatment									
Indicated report of abuse/neglect from ages 4 to 17,%	1408	5.0	10.3	-5.3	<.001	6.3	7.7	-1.4	.35
Juvenile Arrest by Age 18									
Petition to juvenile court, %	1404	16.9	25.1	-8.2	.003	19.8	19.8	0.0	.99
Petition to juvenile court for violent offense, %	1404	9.0	15.3	-6.3	.002	10.8	11.8	-1.0	.58
No. of petitions to juvenile court	1404	0.45	0.78	-0.33	.02	0.56	0.58	-.02	.84
Educational Attainment by Age 20/21									
High school completion, Jan. 2000	1233	49.7	38.5	11.2	.01	46.0	45.6	0.4	.91
High school completion, Sep. 2000	1286	55.7	46.8	8.9	.03	52.2	53.0	-0.8	.82
High school completion, Mar. 2001	1315	61.4	51.5	9.9	.015	56.0	57.0	-1.0	.77
Highest grade completed, Sep. 2000	1286	11.09	10.74	0.35	.02	10.97	10.98	-0.1	.96

Notes: Coefficients for dichotomous and count data are from probit and negative binomial regression analysis transformed to marginal effects, and they are adjusted for sex of child, race/ethnicity, the risk index, and program sites.

(table continues)

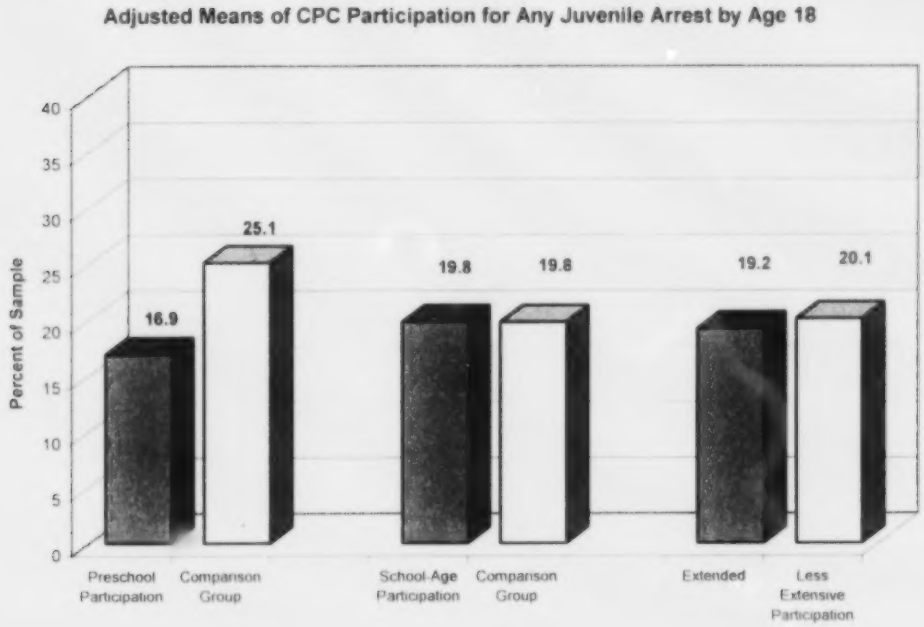
TABLE 4, continued
Domains of Effects for Three Measures of Participation in the Child-Parent Center Program

Outcome Measure	Extended Intervention Group (n = 491)	Nonextended Intervention Group (n = 480)	Difference	p-value
School Achievement				
Age 9 ITBS reading achievement	98.4	93.4	5.0	.004
Age 14 ITBS reading achievement	146.7	143.7	4.0	.012
Age 14/15 consumer skills, % passing	63.7	57.7	6.0	.033
Family Support for Education				
No. of positive ratings (0–5) of parent involvement in school by parents/teachers, ages 8–12	2.2	1.6	0.6	<.001
School Remedial Services				
Grade retention by age 15, %	21.9	32.3	-10.4	.001
Special Education by age 18, %	13.5	20.7	-7.2	.004
No. of years of special education from ages 6 to 18	0.56	1.23	-0.67	.080
Child Maltreatment				
Indicated report of abuse/neglect from ages 6 to 17, %	4.4	7.7	-3.3	.024
Juvenile Arrests by Age 18				
Petitions to juvenile court, %	19.2	20.1	-0.9	.726
Petition to juvenile court for violent offense, %	9.3	12.4	-3.1	.099
Number of arrests	0.48	0.62	-0.14	.320
Educational Attainment by Age 20/21				
High school completion, Jan. 2000	48.7	44.0	4.7	.193
High school completion, Sep 2000	56.0	53.5	2.5	.471
High school completion, Mar. 2001	61.0	58.8	2.2	.526
Highest grade completed, Sep. 2000	11.06	10.92	0.13	.758

Notes: Coefficients are from probit and negative binomial regression analysis transformed to marginal effects, and they are adjusted for sex of child, race/ethnicity, the risk index, program sites, and word analysis scores at the end of kindergarten. The nonextended intervention group had 1 to 4 years of CPC intervention. Samples sizes are at the age 20 follow-up.

Figure 3
CPC Program Effects for Three Measures of Child Well-Being

A. Juvenile Arrest



B. Special Education

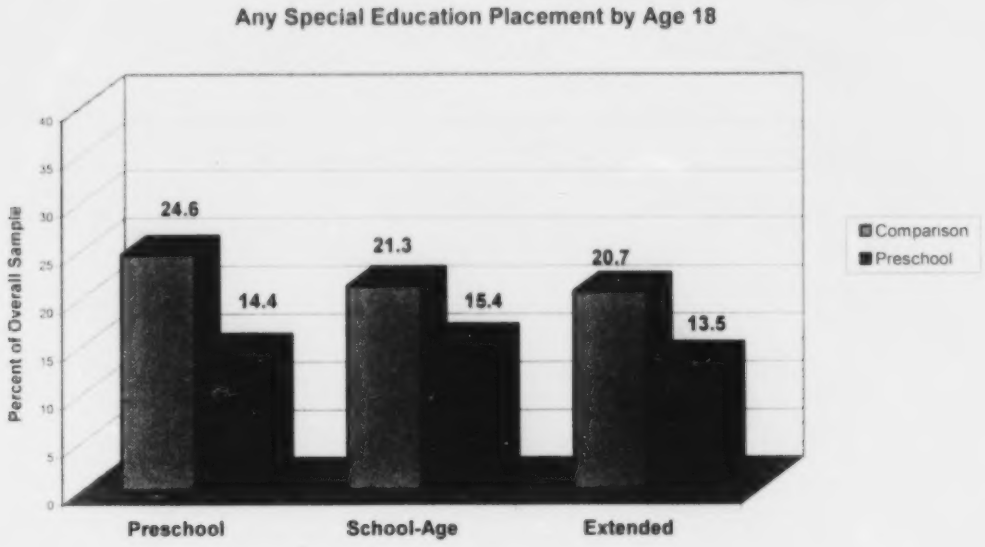
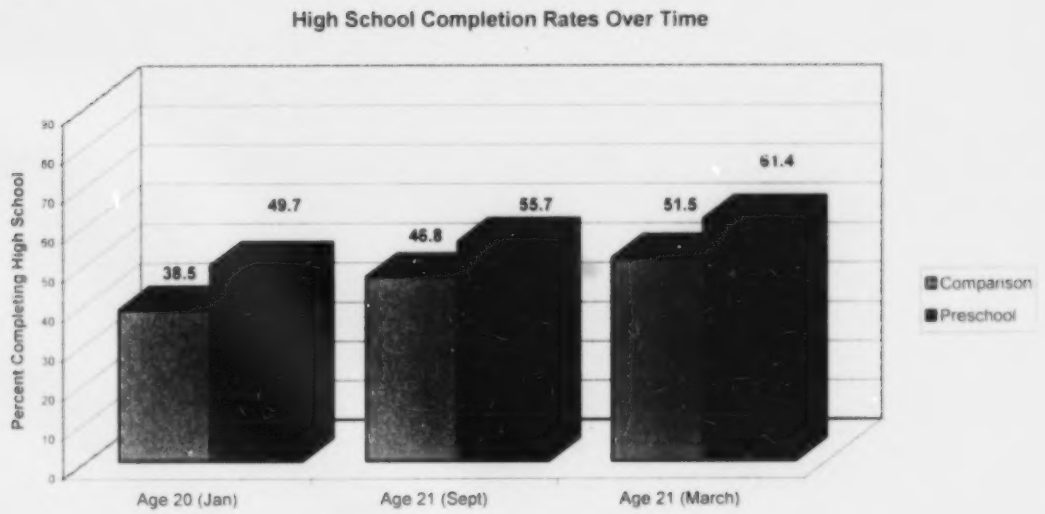


Figure 3 (continued)

C. High School Completion



performance levels of the program groups for educational attainment, special education placement, and juvenile arrest.

Preschool Participation. Participation for 1 or 2 years was associated with nearly all child outcomes up to age 20. Preschool participants had greater cognitive skills at kindergarten entry, higher school achievement leading to reductions in need for school remedial services, and ultimately lower rates of delinquency and higher rates of school completion. In percentage points, participants had an 11-point lower rate of special education placement (40 percent reduction), a 12-point lower rate of grade retention (40 percent reduction), an 8.2-point lower rate of juvenile arrest (33 percent reduction), and an 11-point higher rate of high school completion by January 2000 (29 percent increase; other estimates are in Table 4). By age 17, preschool participants also had a significantly lower rate of child maltreatment than the comparison group (5.0 percent versus 10.3 percent, a 51 percent reduction). Boys benefitted from the program more than girls on the outcomes of kindergarten achievement and high school completion. With the exception of early school achievement, 2 years of preschool provided no performance advantages over 1 year for school remedial services, juvenile arrest, or high school completion.

School-Age Participation. Participation for 1 to 3 years was associated with fewer child and youth outcomes. School-age participation was associated with greater school achievement at ages 9 and 15, and reduced need for school remedial services by 18. The adjusted rates of special education placement were 15.4 percent and 21.3 percent, respectively, for the program and comparison groups. Respective rates of grade retention were 23.8 and 34.3 percent. No group differences were found for juvenile arrest, high school completion, highest grade completed, or child maltreatment.

Extended Program Participation. Relative to participation for 1 to 4 years, program participation for 4 to 6 years beginning in preschool was associated with significantly higher levels of early and later school achievement, less need for school remedial services such as grade retention (21.9 percent versus 32.3 percent), and lower rates of child maltreatment (4.4 percent versus 7.7 percent, a 43 percent

reduction). Program participation was marginally associated with a lower rate of arrest for violent offenses (9.3 percent verus 12.4 percent). Although extended program participation was associated with a slightly higher rate of high school completion, it was not statistically significant. Because the comparison group participated in the program and kindergarten achievement was included as a covariate, these findings reflect the added value of extensive participation above and beyond less extensive participation.

Cost-Benefit Estimates

Tables 5A, 5B, and 5C and **Figure 4** show the present value of costs and benefits in 1998 dollars evaluated at age 3 for the three components of the CPC program. The economic benefits were estimated from the demonstrated effects of program participation shown in Table 4. For example, while the effects of preschool participation led to similar reductions in special education and juvenile arrest, savings to the government were greater for reducing juvenile arrest because the expenditures for providing criminal justice services are higher. We summarize the present value and net present value of the benefits by level of program participation. (See Appendix; contact the authors for additional information on the estimation of program benefits and costs.)

Preschool Participation. Overall, the preschool program generated a return to society of $47,759 per participant by age 21. Total benefits to the general public (taxpayers and crime victims) were $25,771 per participant. These economic benefits substantially exceeded the average cost of the program per participant of $6,692. The largest benefit was program participants' increased earnings capacity projected from higher educational attainment. The largest categories of public benefits, which excluded individual earnings, were increased lifetime earnings projected from increased educational attainment (28 percent) and savings to the criminal justice system in adolescence and adulthood due to lower rates of arrest (28 percent). Reductions in expenditures for school remedial services (18 percent) and savings on tangible costs to crime victims (24 percent) also provided significant benefits to the public. Savings in the

TABLE 5A
Estimated Benefits and Costs of Child-Parent Center Preschool Program per Participant
(present value in 1998 dollars with 3% annual discount rate)

Benefit or Cost	For Participant Only	For Taxpayers/ Crime Victims	Total Society
Measured Effect			
Child care	$1,657	$0	$1,657
Grade retention	0	692	692
Special education	0	4,180	4,180
Child welfare savings	0	472	472
Abuse/neglect victim savings	0	298	298
Juvenile justice savings	0	4,518	4,518
Juvenile crime victim savings	0	3,388	3,388
Total measured	**$1,657**	**$13,548**	**$15,205**
Projected Effect			
Earnings/compensation	$20,517	$0	$20,517
Taxes on earnings	0	7,243	7,243
College tuition	-186	-371	-557
Adult justice savings	0	2,612	2,612
Adult crime victim savings	0	2,739	2,739
Total projected	**$20,331**	**$12,223**	**$32,554**
Total measured/projected	**$21,988**	**$25,771**	**$47,759**
Cost of preschool program	**0**	**-6,692**	**-6,692**
Net present value	**$21,988**	**$19,079**	**$41,067**

TABLE 5B
Estimated Benefits and Costs of Child-Parent Center School-Age Program per Participant
(present value in 1998 dollars with 3% annual discount rate)

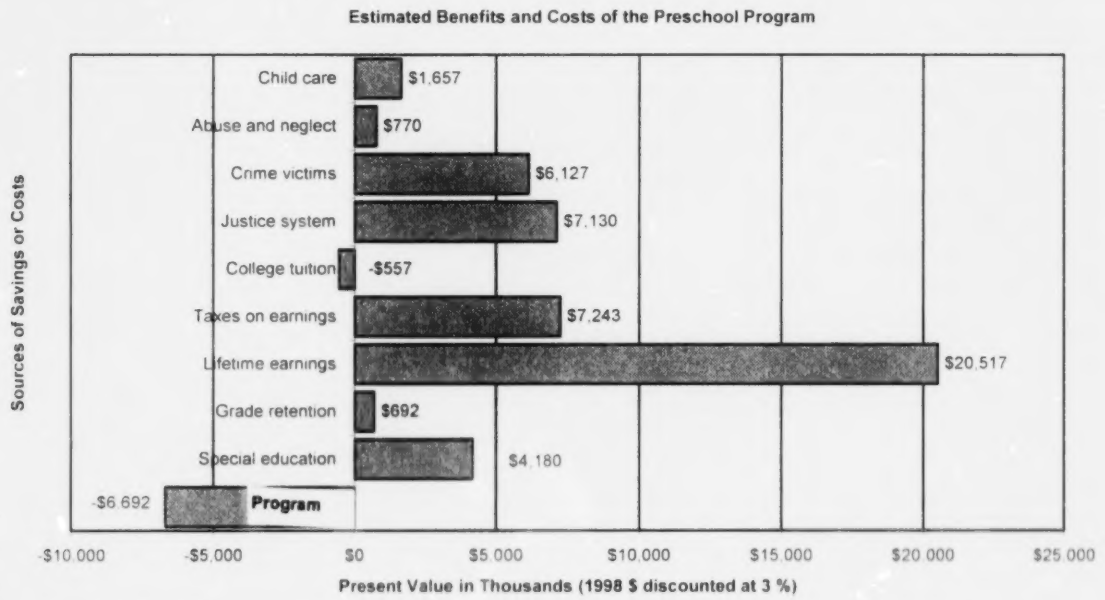
Benefit or Cost	For Participant Only	For Taxpayers/ Crime Victims	Total Society
Measured Effect			
Child care	$0	$0	$0
Grade retention	0	472	472
Special education	0	2,866	2,866
Child welfare savings	0	125	125
Abuse/neglect victims savings	0	79	79
Juvenile justice savings	0	0	0
Juvenile crime victim savings	0	273	273
Total measured	**$0**	**$3,815**	**$3,690**
Projected Effect			
Earnings/compensation	732	0	732
Taxes on earnings	0	259	259
College tuition	-7	-13	-20
Adult justice savings	0	0	0
Adult crime victim savings	0	158	158
Total projected	**$725**	**$404**	**$1,129**
Total measured/projected	**$725**	**$4,219**	**$4,944**
Cost of school-age program	**0**	**-2,981**	**-2,981**
Net present value	**$725**	**$1,238**	**$1,963**

TABLE 5C
Estimated Benefits and Costs of Child-Parent Center Extended Program per Participant
(present value in 1998 dollars with 3% annual discount rate)

Benefit or Cost	For Participant Only	For Taxpayers/ Crime Victims	Total Society
Measured Effect			
Child care	$1,646	$0	$1,646
Grade retention	0	467	467
Special education	0	4,001	4,001
Child welfare savings	0	294	294
Abuse/neglect victim savings	0	186	186
Juvenile justice savings	0	1,917	1,917
Juvenile crime victim savings	0	2,368	2,368
Total measured	**$1,646**	**$9,233**	**$10,879**
Projected Effect			
Earnings/compensation	$8,610	0	$8,610
Taxes on earnings	0	3,040	3,040
College tuition	-78	-156	-234
Adult justice savings	0	1,108	1,108
Adult crime victim savings	0	1,369	1,369
Total projected	**$8,532**	**$5,361**	**$13,893**
Total measured/projected	**$10,178**	**$14,594**	**$24,772**
Cost of extended program	**0**	**-4,057**	**-4,057**
Net present value	**$10,178**	**$10,537**	**$20,715**

Figure 4
Benefits and Costs for Three Measures of CPC Program Participation

A: Preschool participation



B: School-age participation

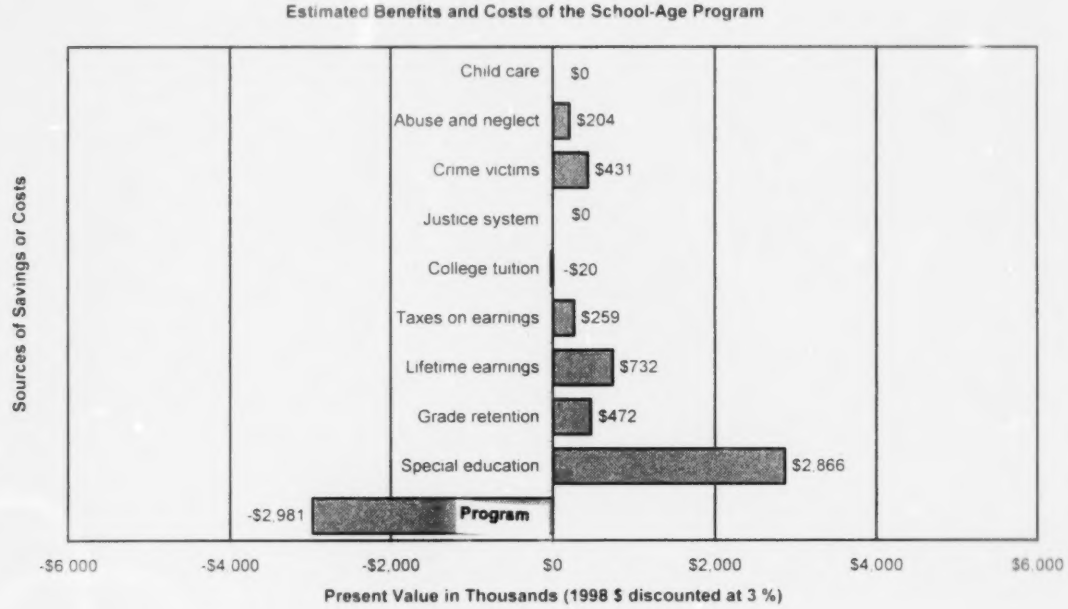
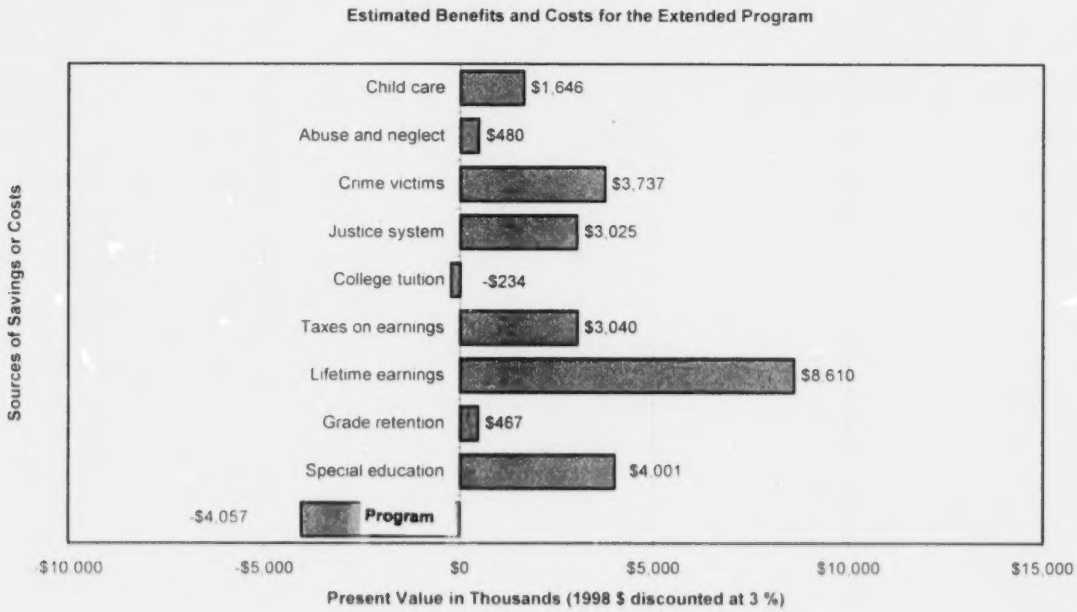


Figure 4 (continued)
Benefits and Costs for Three Measures of CPC Program Participation

C: Extended participation (4–6 years versus 1–3 years)



child welfare system associated with lower rates of child maltreatment were also among program benefits.

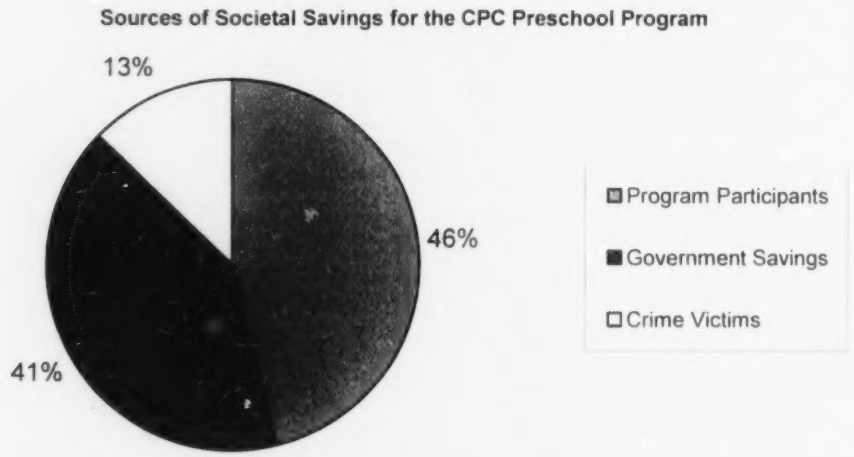
As shown in **Figure 5A**, benefits to program participants accounted for 46 percent of the total societal benefit, government savings for 41 percent, and crime-victim savings for 13 percent. The preschool program provided savings to the government of $19,346. The largest share of government savings, exclusive of crime-victims savings, was in reduced costs to the juvenile and adult criminal justice system (43 percent). Other government savings included increased tax revenues, reduced school services, and reduced expenditures in the child welfare system.

We also estimated the present value of benefits in 1998 dollars for two subgroups of program participants. One and 2 years of preschool provided similar amounts of benefits to society ($51,350 and $43,820) and to the public ($27,247 and $26,261), respectively. This finding suggests a diminishing return of the second year over the first year, which is consistent with a previous report from the study.[42] Respective societal and public benefits of preschool participation for boys ($60,635 and $34,835) substantially exceeded those of girls ($31,238 and $16,402). This was primarily due to findings that boys experienced a greater program effect on high school completion and, to a lesser extent, special education placement.

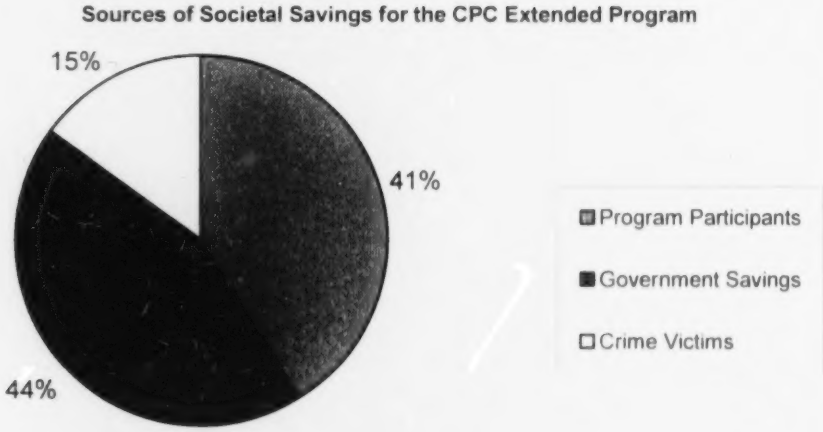
School-Age Participation. The present value of benefits for the school-age program was substantially lower than for the preschool program. This was because school-age participation was not associated with juvenile arrest and high school completion. The school-age program provided a societal return of $4,944 per participant. Given a discounted cost of $2,981, benefits modestly exceeded the investment in the program. The primary benefit was lower costs of special education services. This benefit nearly equaled the cost of the program. Savings due to reductions in grade retention and to juvenile and adult crime victims also were notable. Benefits to the public (taxpayers and crime victims) exceeded costs as well. Indeed, nearly all the benefits of the school-age program were public benefits.

Figure 5
Sources of Societal Savings for CPC Preschool and CPC Extended Participation

A. CPC Preschool Participation



B. CPC Extended Participation



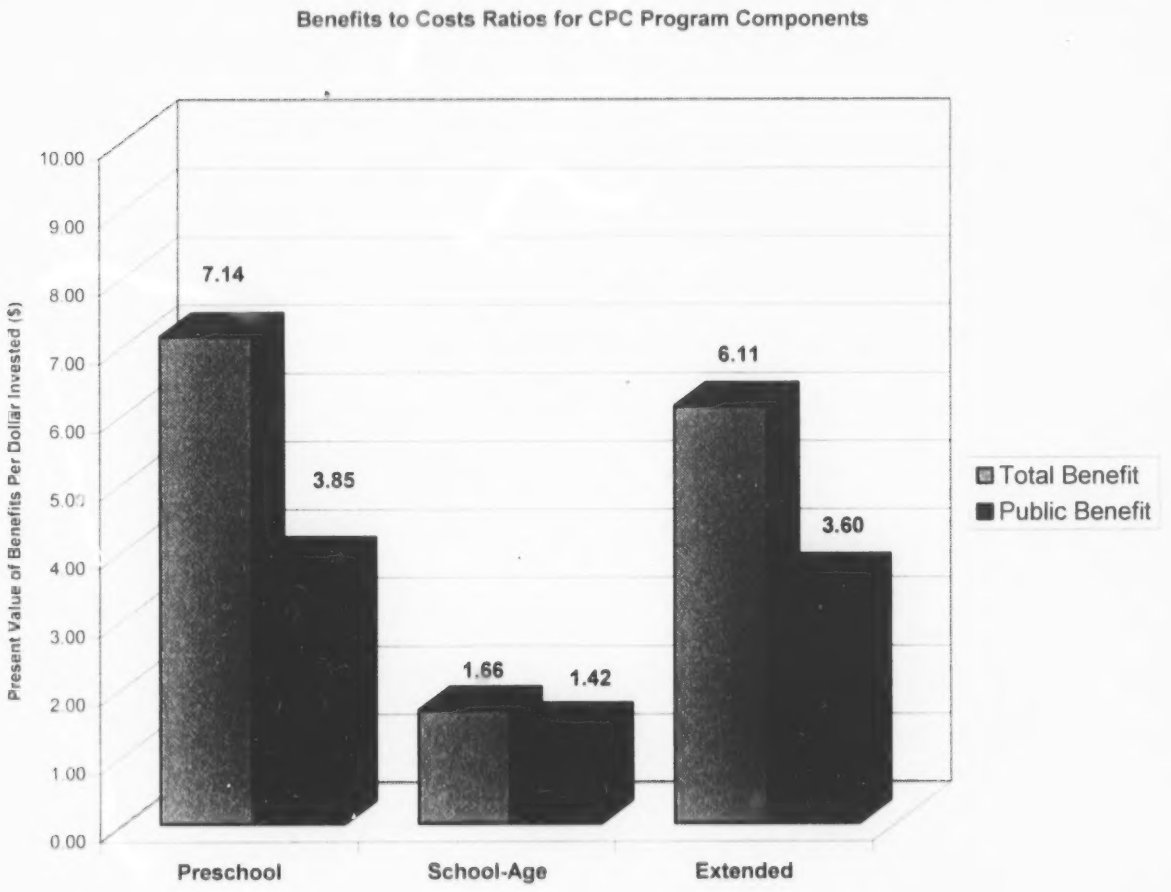
In contrast to preschool, length of school-age intervention was positively associated with economic benefits. The societal and public benefits of 2 or 3 years of school-age intervention exceeded those of 1 year by, respectively, $17,516 and $9,167. Moreover, girls experienced substantially greater economic benefits than boys from school-age participation.

Extended Program Participation. Relative to participation for 1 to 4 years, participation in the program for 4 to 6 years (preschool to second or third grade) also was associated with economic benefits that exceeded costs. Overall, extended program participants typically had the highest levels of performance in the study. The present value of benefits to society at large was $24,772 per participant. Given a net average cost of $4,057, the extended intervention program provided a substantial return to society at large. The greatest benefit to individual participants was increased earnings capacity due to educational attainment. Benefits to the general public were $14,594. The largest category of public benefits was reduced special education expenditures. Combined criminal justice system savings and averted tangible crime-victim expenditures also contributed to program benefits. Measured effects for grade retention and child welfare system and victimization expenditures were relatively small. As with preschool, boys benefitted more than girls from the extended program. The present values of societal and public benefits for boys were, respectively, $34,064 and $22,253, compared with benefits for girls of $13,131 and $3,861. Moreover, the public benefits of 5 or 6 years of participation were about double those of 4 years ($21,093 versus $10,245).

Benefit-to-Cost Ratios

Figure 6 provides a summary of the CPC program's monetary return to society as a ratio of benefits to costs. The total benefit to society was largest for the preschool program. Every dollar invested in preschool returned $7.14 in educational, social welfare, and socioeconomic benefits. The total public benefit was $3.85 per dollar invested. These are substantial levels of cost-effectiveness. The societal

Figure 6
Benefit to Cost Ratios for Three Measures of CPC Program Participation



benefit-to-cost ratio for 1 year of preschool was more than twice that of 2 years ($12.02 versus $5.05 per dollar invested). Likewise, preschool boys experienced a larger societal benefit-to-cost ratio than program girls did ($9.06 versus $4.67 per dollar invested).

Although having lower benefit-to-cost ratios than the preschool program, the school-age and extended intervention programs provided returns that exceeded costs. Their respective benefit-to-cost ratios of $1.66 and $6.11 to society at large and $1.42 and $3.60 to the general public show they can contribute positively to educational reforms. Values for the extended intervention program were close to those for the preschool program. The societal benefit-to-cost ratio for the school-age program was higher for girls than for boys ($3.81 versus $1.15), while boys experienced proportionally greater benefits than girls from extended intervention ($8.37 versus $3.23). The societal benefit-to-cost ratio for 5 or 6 years of the extended program was nearly twice that of 4 years of participation ($5.61 versus $2.92). Although providing less-comprehensive services than the preschool program, the main attributes of the school-age program—lower class sizes and instructional coordination in the early school grades—are relatively easy to implement.

Sensitivity Analysis

Because benefit estimates vary as a function of the discount rate, we estimated program benefits using discount rates from 0 percent to 7 percent. Economic benefits of preschool participation to society, to the general public, and to government exceeded program costs even under the highest discount rates of 5 percent to 7 percent. Findings based on a 5 percent annual discount rate, for example, yielded a benefit-to-cost ratio to society of about $5 per dollar invested and to the general public of about $3 per dollar invested. The economic benefits of extended program participation also were robust to different discount rates. The benefits of school-age participation were less robust to alternative discount rates, but returns to society exceeded costs for most of the discount rates.

Alternative procedures for estimating lifetime earnings and compensation, such as the use of different age cohorts (e.g., 1998) and earnings measures (e.g., any work experience) yielded findings that were qualitatively similar to those reported. Similar patterns of findings were found with alternative estimates of savings to the criminal justice system. Our findings on savings to crime victims may be conservative since only tangible savings were measured, such as property losses and hospitalization. Because intangible costs to crime victims (e.g., pain and suffering, risk of death) have been estimated to be about three times tangible costs,[4, 37] the inclusion of averted intangible costs associated with juvenile and adult crime would have added, in present-value 1998 dollars, savings of $20,178 per participant for preschool, $1,379 for school-age intervention, and $11,958 for extended intervention.

DISCUSSION

As the first cost-benefit analysis of a federally financed and large-scale early childhood intervention in public schools, our findings indicate that all levels of participation in the Chicago Child-Parent Center Program were associated with economic benefits that exceeded costs. The preschool program, the most intensive and comprehensive component, yielded the greatest benefits by age 21. For every dollar invested in the preschool program, about $4 were returned to the general public through government savings on school remedial services, criminal justice system and child welfare system costs, and averted crime-victim expenditures. About $7 were returned to society at large for each dollar invested through increased economic well-being and reduced public expenditures on educational and social welfare services. The largest share of benefits was attributable to the link between preschool participation and higher rates of school completion and lower rates of juvenile arrest, which in turn led to greater projected economic and social benefits over the life course. Boys and 1-year preschool participants experienced proportionally the greatest amount of economic benefits from preschool.

School-age and extended programs also redeemed their costs and provided positive benefits to society and the general public. Boys and 5- to 6-year participants benefitted most from extended intervention.

Findings contribute substantially to knowledge about the benefits of early childhood programs for low-income children. They indicate that large-scale contemporary programs implemented by school districts can lead to major benefits that improve children's well-being and later quality of life. By providing comprehensive and intensive services to children and families over several years, the CPC program appears to reduce the likelihood of later scholastic and social difficulties and to enhance well-being. The observed links with educational attainment and crime prevention are especially significant given that school dropout and crime are general risk factors for several leading health indicators described by the Surgeon General in the Healthy People 2010 Initiative,[43] including tobacco use, substance abuse, mental illness, and injury and violence. Low educational attainment also is associated with lower rates of health insurance coverage and reduced access to quality health care. Thus, higher educational attainment promotes greater use of preventive health services and lowers the risk of disease.[44, 45] Because the study sample is almost all African American, early childhood interventions like the Child-Parent Centers also may help reduce racial disparities in health outcomes and service utilization. Although preschool participation beginning at age 3 showed the greatest benefits relative to costs, findings demonstrate that public programs which provide a broad array of educational and family support services in the first decade of life can make a substantial difference in the lives of children nearly two decades later. These effects have measurable economic benefits. Moreover, the evidence of long-term beneficial effects for early childhood interventions like the Chicago Child-Parent Centers is substantially greater than for other types of programs.[15, 46] Findings support greater levels of investments in young children's learning and development.

Our cost-benefit findings are similar to those reported in studies of the High/Scope Perry Preschool Program and the Prenatal/Early Infancy Project.[3, 14] Findings also compare favorably with the

federally funded WIC program.[12] Our finding of about $3 of government saving for every dollar invested in preschool, for example, is in the middle of the range of $2 to $4 reported for these three programs. The CPC program differs from these programs in several respects, however. Like the Head Start program, the Child-Parent Centers provide comprehensive services, including intensive family support activities, health and social services, and center-based preschool education. The other programs targeted early education or health services with less emphasis on family and social services. In contrast to model programs, the Child-Parent Centers also are established, federally financed programs in different sites within existing educational and social agencies. The main economic benefits of WIC are reduced hospital costs to public and private payers due to lower rates of low birth weight, but these benefits do not extend to the educational and social outcomes targeted in comprehensive early childhood programs. Consequently, compared with other programs, the generalizability of findings from the school-based CPC program to contemporary state and local programs is high.

Although the economic benefits of the school-age and extended intervention components were lower than those of the preschool component, they indicate an efficient use of services. The school-age program from first to third grades, through smaller class sizes and enriched instruction, reduced the need for later remedial education and provided a continuum of intervention services necessary to support the successful adjustment of children at risk. The benefits of the extended intervention program exceeded costs by a factor of 6 and support the added value of program participation in the early grades. Indeed, children who participated in the extended intervention program from preschool to second or third grade had the highest levels of educational attainment and lowest rates of school remedial services and arrest. Benefits of extended intervention also were greater for boys and for participants enrolling for 5 or 6 years.

Why didn't the school-age program yield greater economic benefits? The school-age program provided fewer and less intensive services than the preschool program. In addition, the criterion for

demonstrating effectiveness for extended intervention was high because the comparison group was not only enrolled in school full time but had up to 4 years of program participation. The combined and possibly synergistic effect of preschool and school-age intervention was not tested because kindergarten achievement, an outcome of preschool participation, was included as a covariate in the model to estimate the effects of extended intervention. Nevertheless, as reported in previous studies,[18, 19] the CPC program provides a single system of early education from ages 3 to 9 that enhances children's well-being, including school performance.

Why do investments in early childhood education lead to positive outcomes of such economic significance? Unlike most other intervention programs, the Child-Parent Centers provide comprehensive and intensive services to families over extended periods of time. Structured literacy and parent involvement activities are especially significant. High quality is mostly attributable to the fact that as public school teachers, staff are relatively well-paid, have at least bachelor's degrees with certification in early childhood education, and participate in ongoing professional development activities. Within this structure, three generative mechanisms integral to the theory of the program have been identified to account for long-term effects.[15] The first is the cognitive and literacy advantage that promotes school readiness among program participants. This initial cognitive advantage enhances early school performance, culminating in higher educational attainment and lower rates of crime. The second mechanism that explains the long-term effects of intervention is family support behavior. Because program participation has been found to enhance parental involvement in children's education, this greater level of involvement continues after the end of the program and helps to maintain the learning gains experienced during the program. The third mechanism of intervention effects supported by previous research in the study is postprogram school support. Relative to the comparison group, children who participate in the CPC program are more likely to attend elementary schools of higher quality and are less likely to change schools. These later school experiences are directly associated with educational

attainment and delinquency prevention.[47] Enhancing the quality of the school environment is a major goal of extended early childhood programs.[48, 49] Family and school support factors are independent of the early cognitive advantages experienced by program participants. These three generative mechanisms also influence each other to provide long-term benefits. Future investigations may reveal additional mechanisms that also are coherent with the theory of the program.

This study has two limitations. First, our estimates of increased earnings capacity over the life course and cost savings in the adult criminal justice system and for crime victims were based on projected rather than measured effects. It is possible that benefit estimates could be altered during the adult life course in either direction. Future economic and social conditions are difficult to predict with confidence and could affect the assumptions underlying the analysis concerning productivity and discounting. Reductions in marginal tax rates, for example, would reduce our estimates of tax revenues. Increased economic productivity would likely increase estimates of individuals' earnings. Nevertheless, the projected benefits are based on educational attainment and juvenile crime at the beginning of adulthood, the strongest respective predictors of later economic well-being and criminal behavior.[50, 51] In addition, our findings are likely to be robust because estimated benefits were spread across several outcomes and did not depend on any single measure. The robustness of our findings is further supported by cost-benefit analysis of the High/Scope Perry Preschool Program, in which estimated benefits increased from age 19 to age 27 follow-up assessments.[14]

The second limitation is that the benefits of several outcomes of the program were not measured. The relationship between educational attainment and nonlabor-market benefits[36] suggests that program effects on children's education may have a positive influence on health status and future family health status, fertility choices, and even the amount of schooling obtained by one's children. Reductions in the need for participation in welfare programs also are possible, and we made no attempt to estimate their economic benefits. Moreover, because the CPC program provides comprehensive services that extend

beyond the children served, changes in parents' own education and employment may occur and should be explored in future studies. The demonstrated link between educational attainment and health status also may lead to lower disease risks that often go unmeasured in cost-benefit studies.[42] These issues deserve further investigation. Thus, our findings are likely to provide a lower-bound estimate of the benefits of program participation. Some of these unmeasured benefits could be neutralized by greater expenditures by or on behalf of program participants for furthering their education and consuming greater public services.

In conclusion, based on standard economic procedures of cost-benefit analysis, findings show that a comprehensive child-development intervention has substantial long-term benefits to society through increased economic well-being and reduced expenditures for remediation and treatment. Given limited financial and human resources for health and educational interventions for young children, greater levels of public investments in programs and policies with demonstrated cost-effectiveness are warranted. Unlike many social programs, the Chicago Child-Parent Center Program provides benefits to society that far exceed costs and is routinely financed by and implemented in public schools. The present value of public benefits of the preschool program for the nearly 1,000 participants in the study totaled $26 million. Since 100,000 children have been served by the program to date, these benefits translate to as much as $2.6 billion (1998 dollars) in public savings since the program opened. As states and localities increase access to early childhood care and education programs, public schools appear to be a location of choice for these initiatives. The findings of this study show the long-term payoffs that these public programs can provide.

APPENDIX
Breakdown of Benefits and Costs for Estimating Economic Returns of the Chicago Child-Parent Centers

Category of Benefits and Costs	Year of Original Estimate	Estimate in $1998	Present Value in $1998	Average Age When Benefit or Cost Occurred	Estimated Benefit of Preschool Program in $1998	Estimated Benefit of School-Age Program in $1998	Estimated Benefit of Extended Program in $1998	Primary Sources for Estimates
Program Benefits								
1. Grade retention (ages 5–14)								
a. Expenditure for one additional year	1996	$7,211	$4,494	19	$692	$472	$467	Illinois State Board of Education (1997)
2. Special education (ages 6–18)								
a. Expenditure for one year	1995	$7,791	$5,971	12	$4,180	$2,866	$4,001	Chicago Public Schools (1995)
3. Projected lifetime earnings/compensation								
a. HS completion versus noncompletion	1998	$285,393	$183,183	18	$20,517	$732	$8,610	U. S. Census (1999); Barnett (1996)
4. Projected taxes on earnings (ages 18–65)								
a. HS completion versus noncompletion	1998	$100,758	$64,673	18	$7,243	$259	$3,040	U. S. Census (1999); see note below
5. Justice system (ages 10–44)								
a. Expenditure per crime (ages 10–18)	1998	$18,950	$13,690	14	$4,518	0	$1,967	Cohen (1988); BJS (1997); IDOC (1999)
b. Expenditure per crime (ages 19–44)	1993	$69,038	$32,973	NA	$2,612	0	$1,108	Karoly et al (1998); Greenwood et al. (1998)
6. Crime victims (ages 10–44)								
a. Tangible costs per victim (ages 10–18)	1998	$19,869	$14,354	14	$3,388	$273	$2,368	Karoly et al (1998); Barnett (1996); Miller et al. (1996)
b. Tangible costs per victim (ages 19–44)	1993	$71,454	$34,572	NA	$2,739	$158	$1,369	Karoly et al (1998); Greenwood et al. (1998)
7. Child abuse and neglect								
a. Tangible victim costs per report (ages 4-17)	1993	$6,916	$5,623	10	$298	$79	$186	Miller, Cohen, and Wiersema (1996); DHHS (1997)
b. Expenditures to child welfare system	1995	$10,958	$8,910	10	$472	$125	$294	Courtney (1998); Larner et al. (1998)
8. Child care (ages 3–4)								
a. Average per child (1.5 years of preschool)	1986	$1,080	$1,049	4	$1,657	0	$1,646	Minimum wage based on 540 hours per year (1993,1996)

APPENDIX, continued

Category of Benefits and Costs	Year of Original Estimate	Estimate in $1998	Present Value in $1998	Average Age When Benefit or Cost Occurred	Estimated Benefit of Preschool Program in $1998	Estimated Benefit of School-Age Program in $1998	Estimated Benefit of Extended Program in $1998	Primary Sources for Estimates
9. College tuition (ages 18–22)								
a. Public expenditure for two years (2/3)	1998	-$5,161	-$3,313	18	-$371	-$13	-$156	2- and 4-year average for Chicago area colleges
b. Personal expenditure for two years (1/3)	1998	-$2,580	-$1,656	18	-$186	-$7	-$78	Individual portion of total college expenditure
Program Costs								
1. Preschool (ages 3–4)								
a. One year per child	1986	$4,400	$4,272	4	NA	NA	NA	Chicago Public Schools (1986a)
b. Average per child (1.55 yr.)	1986	$6,820	$6,692	3, 4	NA	NA	NA	Chicago Board of Education (2001)
2. School-age (follow-on: ages 6–9)								
a. One year per child	1987	$1,580	1,446$	6	NA	NA	NA	Chicago Public Schools (1986a, 1986b)
b. Average per child (2.14 yr.)	1987	$3,381	$2,981	6–9	NA	NA	NA	
3. Extended intervention (ages 3–9)								
a. Average per child (3.86 yr.)	1987	$10,565	$10,038	3–9	NA	NA	NA	Chicago Public Schools (1986a, 1986b)
4. Total program (ages 3–9)								
a. Average cost per child (3.69 yr.)	1987	$10,201	$9,673	3–9	NA	NA	NA	Same as above

Notes. The benefits of program participation were estimated by multiplying the program coefficient in the explanatory model (see Table 4) by the present value of the outcome in column 4. Grade retention is the average expenditure for one additional year of general education in Chicago reported by Illinois State Board of Education. Special education is the weighted average of four handicapping conditions reported by the Chicago Public Schools: specific learning disability, speech or language impairment, emotional or behavioral disturbance, and mental retardation.

Projected lifetime earnings/compensation estimates assume a 3% discount rate, 2% real income growth rate, and 20% fringe benefit rate. Tax rate is applied to projected lifetime earnings only and assumes a 33.3% tax rate (15% federal, 3% state, and 15.3 FICA). Crime victim costs are tangible expenditures to victims for adjudicated violent and property offenses (Karoly et al., 1998; Barnett, 1996; Miller et al., 1996). Criminal justice system costs include administrative, treatment, and probation expenditures (Cohen, 1988; Bureau of Justice Statistics, 1997; Illinois Department of Corrections, 1999. For additional information on program costs and activities, see Reynolds (2000). Contact the authors for additional information on the estimation of benefits and costs.

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